

SHIFTING CULTIVATION AND ITS EFFECTS ON OF DHALAI RIVER BASIN AND ALTERNATIVE OPTION, TRIPURA, INDIA

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ABSTRACT

Shifting Cultivation or Slash and burn agricultural (locally called as Jhum) is the main form of agriculture in the hills of north east India. In view of the mountainous terrain, settled cultivation constitutes only a small portion of the total cultivated land, which is mostly confined to the valley land. The shifting cultivation is a time-tested system of agricultural practices, most often evolved indigenously and is strongly based on traditional knowledge. It used to be an appropriate and sustainable land use practice in diverse Socio-economic set ups where the dependent human population was within the carrying capacity of a 10-15 year Jhum Cycle. However, today the scientist view is shifting cultivation as environmentally destructive and a faulty land use practice having very low output-input ratio. The shifting cultivation became unsustainable primarily due to the increase in population that led to increase in food demand, the Jhum cycle got shortened which resulted in the overall decrease of crop yield. This necessitated in bringing more virgin forest area, under the shifting cultivation. Thus, the vicious cycle continued and more forest areas were converted to wasteland as a result of repeated Jhum having very short (often 2-3 years) cycles. The present paper describes the status of shifting cultivation in Tripura India and reviews the works done on various alternative farming systems in the region as well as many other possible alternative that may be acceptable to the people of Tripura as modified shifting cultivation practice.

Keywords: Types of Jumias, Land use of Jhumias, Soil loss, Alternative Option

INTRODUCTION

Topographically Tripura consists of a number of hill ranges, hillocks and hilly terrains interspersed with wide fields. Heavy rainfall, rich flora and fauna, fertile fields and temperate climate have drawn numerous groups of people to Tripura from different directions since time long past. This natural environment attracted people in groups to enter Tripura in different weaves from the long past. At present Tripura is a place, where besides 19 tribal groups. Tripura

has a big tribal population. Shifting cultivation is the oldest cultivation system practiced throughout the tropics and subtropics (zones of high rainfall, moderate temperature, and steep slopes), dating back to the Neolithic Period (13000–3000 BC) (Sharma, 1976). In India, shifting cultivation is variously known as *adiabik* in Arunachal Pradesh, *dawarin* Madhya Pradesh, *panda* by the Myrias of Bastar in Madhya Pradesh, *dabi*, *komon*, *pamadohi*, or *bringaamong* the Bhuiyas of north Orissa, *gudiaordhongarcharin* south Orissa, *jhoomin* Assam and Tripura. The Reangs of Tripura use *hooknismong* as a synonym for *jhum*. *Jhumming* as a system of crop husbandry has been an ancient one and more prevalent in the hilly terrains in this part of the world. Geographically, this culture is mostly found in the tropical rainforests characterized with heavy rains and hot weather (Jones & Darkenwald, 1950). *Jhum* cultivation to the tribes of Tripura has over the years been not just an economic activity; rather it is a way of life. *Jhumias* are tribal's who practice shifting cultivation or *jhuming*. In Tripura over 10,039 hectares of land are under *jhum* cultivation a decade ago. Over the years the *jhum* economy has undergone many changes-land available for *jhuming* has decreased; leading to a shortening of the *jhum* cycle and a fall in incomes. Not only has the plight of the existing *jhumias* deteriorated, but a new group of *jhumias* has emerged due to the several 'development' programmes whose plight is even worse. The government has made some efforts at resolving the problems of the *jhumias*. There is no doubt that the twin problems of unemployment and mal-nourishment at the rural sphere can be simultaneously addressed to by proper and planned utilization of available local resources through involvement of local people. *Jhum* cultivation is popularly known as 'Jhum' or 'Hook' by the local Tribal people of Dhalai District in Tripura. It is a very old system of Agriculture prevalent throughout the District in hilly areas inhabited by the Tribal inhabitants. *Jhum* cultivation also is known as shifting cultivation as because the *jhumia* cultivators have to go on shifting their field in cyclic rotation after normally for one year or two years, if soil fertility sustains. It is also known as slash and burn or Rotation Farming. This analysis unearths the impact of rubber plantation on socio-economic life of *Jhumias*.

PROBLEMS

- Why Physical and social change have come among *jhumias* on the dhalai river basin.
- Why rehabilitation are needs among the *jhumias*.

OBJECTIVES

- To make out the change in the physical set up of the study area.
- Impact of *jhum* cultivation on the *jhumias* and others.
- To find the social and physical changes in the *jhuming* areas.
- Estimate the soil loss due to *jhum* cultivation.
- Alternative potion to *jhum* cultivation.

LOCATION OF STUDY AREA

The Dhalai river basin lies in the Dhalai district of Tripura and it is one of the longest river in Tripura. The basin starts from the northern part of the district with the areal extension of 24°13'18.38N and 91°46'41.44E and end almost 23°50'34.34N,91°57'43.76E. the basin flows through two blocks. Ambassa and Salema Block and it is composed of one Agri sub-division that Salema Agri sub-division at Kamalpur. Being a backward, hilly and tribal population dominated area a wide range of areas are found to be dominated by jhum cultivation. For accessing the impact of jhum cultivation on the geo environmental changes I have used the following instruments, techniques and software's:

Materials

- i) Satellite data like TM and SRTM of 1989 and 2009 are used to locate the changes in the environment due to jhum cultivation. Specially vegetation changes.
- ii) Bhuban landuse map of 2005 to locate the jhum areas in the study area.
- iii) Google Earth image of 2005 and 2013 is used to show the land use changes and also various changes and impact of jhum cultivation.
- iv) Household data collection for Jhum cultivation to rubber cultivation.

Parameters

- i) Soil loss due to jhum cultivation
- ii) Social impacts of jhum cultivation

Methods

- i) Universal soil loss method is used to calculate the soil loss due to jhum cultivation in the jhum hill in the taken area.
- ii) Tools like Geometica 10.3 is used to digitise the jhum areas of the Dhalai river basin from the Bhuban Land use map 2005.
- iii) For preparing the land use maps and cutting bands of the studt area Global Mapper is used.

SHIFTING CULTIVATION IN TRIPURA (DHALAI RIVER BASIN)

Although practices under shifting cultivation vary widely in different parts of north-east and the variability in practices are largely tribe-specific, the shifting cultivation in its any form invariably involves clearing of vegetation, and then slashing and burning the plant parts including debris (Tripathi and Barik). Our study area that are under jhum cultivation in the Dhalai districts are

Salema Block, Ambassa Block, Gandachera and Manu. Jhum cultivation is most prominent in the hill ranges of Atharamura and Longtarai but the Dhalai river basin occupies two blocks of Dhalai districts. They are Ambassa and Salema block. The total geographical areas of the two blocks are 58481 hector and 15514 hector. In the household survey of the two blocks we found that about 66.67% of the villagers in Salema and 73.33% in Bagmara (Ambassa) under Jhum Cultivation.

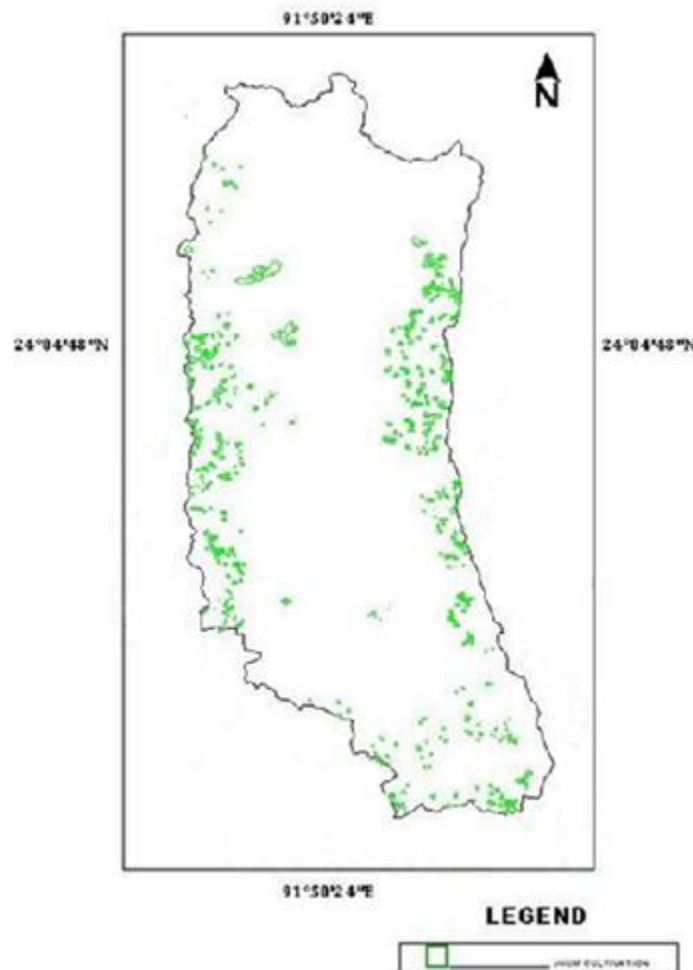


Fig 1: Jhum Caltivation of Dhalai

CATEGORIES OF JHUMIAS

Most of the tribal people, who are commonly called Jhumias, are not purely so. A number of tribal people have taken to settle plough cultivation. Some are in the processes of becoming sedentary farmers. But both of these categories of people do some amount of jhumming.

Different classes of shifting cultivation in the area may be classified into the following three categories: Jhumias by choice: the tribal people who have got permanent land and home sheds but being near to the hills, jhum a small area only to produce cotton and some vegetables which are easily grown in the jhum. To this category belong Tripura, Jamatia, Noatia, and few Halams and few Riangs. Incipient jhumias: this category consists of tribal people who have reclaimed some land in the foot hills and loongas and have started plough cultivation out of their own choice. But because of inadequate income, owing either to insufficient land tilled or insufficient plough farming, they practice jhumming as a supplementary source of income. Pure jhumias: pure jhumias entirely depend on jhumming for production of their food and do not possess any plainland for plough cultivation. They do not allow the art of ploughing at all. "The whole process of Jhumming is clean and keeps the tribal in the open, enjoying the cool mountain breeze, singing and dancing. No wonder the tribal refuses to go down to the valleys to lead a more 'settled' life on the paddy field! Work and leisure for him are not two distinct and mutually opposing entities; they are two sides of the same coin" (Saigal, 1978). With reduction in 'Jhum Cycle' from 20-30 years, the land under shifting cultivation loses its nutrients and the top soil. With reduction in crop yield, the families start moving to other virgin areas. Due to increasing requirement for cultivation of land, cycle of cultivation followed by leaving land fallow has drastically reduced. Earlier the fallow cycle was of 20-30 years duration, thereby permitting the land to return to natural condition (Patro and Panda, 1994). Due to reduction of cycle to 2-3 years, the resilience of ecosystem as broken down and the land is increasingly deteriorating. Moreover, frequent shifting from one land to the other has affected the ecology of the environment (Ramakrishna, 1992). Repeated short-cycle jhumming has created forest-canopy gaps which are evident from the barren hills (Borthakur et al, 1982). The following table shows the Tribal population of Tripura according to the Census of 1981.

Table No 1. Tribals in tripura

Sl. No	Name of tribe	Population	Percentage
1.	Tripuri or Tripura	250382	55.57
2.	Reang	64722	14.36
3.	Jamatia	34192	7.59
4.	Chakma	28662	6.36
5.	Halem	19076	4.23
6.	Noatia	10297	2.28
7	Mog	13273	2.94

8	Lushai	3672	0.81
9	Uchai	1061	0.21
10	Kuki	7775	1.72
11	Garo	5559	1.23
12	Munda	5347	1.18
13	Orang	3428	0.78
14	Santal	2222	0.49
15	Khasia	491	Negligible
16	Bhil	169	Negligible
17	Chimal	Nil	Nil
18	Bhutia	3	Negligible
19	Lepcha	175	Negligible

Source: Government of Tripura, Department of Tribal welfare

Tripuri holds the top most population position in Tripura and Reang. Originally the Jhum cultivation is done by the reang tribes but now a day's almost all the tribals are engaged in the cultivation.

IMPACT OF JHUM CULTIVATION ON DHALAI RIVER BASIN

North-east India is a hilly region and Tripura is a part of it. Being a hilly terrain, the people those who are living in the hills or uplands practice shifting cultivation as they don't have alternative source to cultivate and produce crops. The impact of Jhum or shifting cultivation is having good and bad aspects which are as follows:

Positive Aspects of Shifting Cultivation

Shifting cultivation facilitates the tribal people to preserve their rich cultural traditions and diversity as Jhum cultivation is interwoven into the cultural and tradition of near about 19 tribe those inhabit basically in the hilly parts of Tripura especially in Dhalai and North Tripura district. Shifting cultivation is a labor intensive and low subsidy based farming system, provides an assured source of food production and security to the nourishment level of the jhumias in the hilly parts of Tripura. Shifting cultivation in its traditional form may also put in towards the conservation of agro-biodiversity, principally the native food crops like rice, various vegetables and even different fruits. They usually cultivate 8-10 varieties of crop items in a particular

Jhumming land, in that way they can produce more food in a single time-frame. Tripura is a landlocked state of India and the Physical infrastructure of this state is not well established, so the jhumias are not used the modern agricultural tools and chemicals and pesticides. So in this way, they are not damaging the chemical properties of soil as well as they have their own cultivation process to do Jhum which also prevent soil erosion a bit or partially. Therefore, Jhum cultivation is having some positive aspects and Govt. of Tribal allows tribal people to do Jhum in some extent but through improved and modern way as Jhum provides base for low external input agricultural technologies.

Negative Aspects of Shifting Cultivation

Problems relating to shifting cultivation through slash and burn are not new in Tripura. As early as 1876, W.W. Hunter in his book, 'Statistical Account of the Hill Tipperah' had marked that the "regression of forests had already started in hills because of shifting cultivation practiced by almost the whole population numbering less than 50000 who were all tribals". Jhum cultivation starts with cutting and burning of trees and leads to degradation of forest or deforestation in the hilly areas where they used the land to do jhum. Deforestation has negative effects on the environment which ultimately leads to climate change which nowadays a matter of global concern and many international, national and regional level agencies are working on it. Deforestation may also affect the flora and fauna which existing in the forest. One of the most vital negative environmental impacts of shifting cultivation is the damage that causes to the soil system. It accelerates the soil erosion manifold. Besides causing air pollution due to burning, shifting cultivation is responsible for loss of soil nutrients and useful soil fauna and microbes. Burning of slash lowers soil acidity, organic matter and total nitrogen, but enhances phosphorus and cations.

Due to decline of jhum cycle, the soil fertility and top soil cover in the jhumming lands has been diminishing to a certain extent that it is not naturally possible to get back its previous fertility and other things which eventually converts the jhumming plots into degraded wastelands. The net changes in soil available for nutrient pool from pre-cropped stage through slashing, burning and subsequent cropping result in substantial lowering of carbon, nitrogen and magnesium. Most shifting cultivation practices are subsistence level farming system having very low output/ input ratio compared to other farming systems/ methods. The clearing of forest areas at regular and frequent intervals for shifting cultivation results in the loss of primary forests and formation of secondary forests. This causes substantial loss to tree diversity and associated vegetation those are adapted to primary forests. Excessive shifting cultivation may cause serious soil erosion and sometimes may lead to flood.

IMPACT ON SOIL LOSS

Jhum cultivation has a direct impact on soil loss in the hills. During jhum cultivation the vegetation of the hill is cleared by which the top soil becomes open to the atmosphere and thus result to the soil loss. To measure the soil loss USLE method is used. For carrying on my work I prepared various maps like contour map, slope map, dem and tin elevation map. The Universal Soil Loss Equation (USLE) was developed in the United States in the mid 1960's, and was revised (RUSLE) for Canadian conditions in the 1990's to estimate soil losses due to surface runoff:

$$A = R \times K \times L \times S \times C \times P$$

Where,

A = soil erosion loss in tones / hectares

R = Rainfall factor

K = Soil erodivity factor

L = length of soil factor

S = Slope factor

C = Cropping system / ground cover factor

P = management Practises factor

R = Average rainfall of last 10 years in mm =

$$K \longrightarrow [2.1 \times (12 - OC) M^{1.14} / 104 + 3.2 (S-2) + 2.5 (P-3) / 100]$$

M = particle size = [% M = { % of Salt + % of Sand } x {100% - % of Clay}]

S = structure = 1

P = Permiability =1

LS \longrightarrow Slope $\phi = \tan^{-1} (AB/BC)$

Slope length = $AC^2 = (AB^2 + BC^2)$

$$LS = (p/22.1)m \times (65.41 \sin^2\phi + 4.56 \sin \phi + 0.065)$$

COMPARISON BETWEEN JHUM AREA AND PRODUCTION

The total geographical areas of the two blocks are 58481 hector. The agricultural distribution of two blocks:

Table No 2. Jhum cultivation in salema - agri subdivision

Year	Area		Production		Yeild	
	Salem	Dhalai	Salem	Dhalai	Salem	Dhalai
2000-01	390	2475	285	1805	730	730
2001-02	2010	5065	1865	4455	928	880
2002-03	1200	4827	1100	4441	917	920
2003-04	1190	550	1100	3800	927	835
2004-05	1195	5008	1075	5100	900	1018
2005-06	1406	4607	1125	5594	800	1214
2006-07	1615	5005	1124	4755	382	950
2007-08	1625	5042	1304	4042	803	802
2008-09	1635	5054	1430	5082	875	1006
2009-10	1320	5147	5141	5141	1267	999

Source: Agartala Agriculture Department

From the above graph of 2012 agricultural report of salema agricultural sub-division we can make out that in the present situation forest holds the grater land cover areas in Ambasa then from the Salema blocks, where as all the other cultivable area in the graph shown are more therein Ambasa block Jhum cultivation holds a very small portion of the areas in both the districts but in companison Salema has the highest area in hector than Ambasa.

Table No 3: Jhum cultivation

Year	Dhalai district Area (ha.)	Salema - agri subdivision area (ha.)
2000 – 01	390	2475
2001-02	2010	5065
2002 – 03	1200	4827
2003 – 04	1190	1550
2004 – 05	1195	5008
2005 – 06	1406	4607
2006 – 07	1615	5005
2007 – 08	1625	5042
2008 – 09	1635	5054
2009 -10	1320	5147

From the survey report we came to know that the time of gap that the Jhumias leave barren to the Jhumed land have now reduced.

The Jhumias used the same land which is Jhumed on the other cropping pattenen or types of crop may very Jhum cultivation in Ambasa and Salema Block comes under the some agricultural sub-division, that is Salema agricultural subdivision. Thus the rate of Jhum Cultivation area, production and yield in the areas from the year 2001-2010.From the above graph we can make out that the year 2000-01 to 2004-05 the rate of production and area of cultivation is proportionately changing in same rate, where as in comparison to both the rate of yield is not changing accordingly. In the year 2000-01 to 2002-03 the yield is very low where the area and production is high. Again a sudden fall in yield is noticed in 2005-06 and after that it started rising and in 2009-10 even it reached equals to the area cultivated and production even crossed the total area cultivated to Jhum. It defects that the equal the area of Jhum cultivation is decreasing but the amount of production and productivity is increasing. It might be because of the many rehabilitation plans implemented by the government to facilitate the jhumias. The jhumias even grow two or three types of crop at a time to increase their productivity.

SOCIAL IMPACT

Change in education: with an improvement of all the status of the jhumias they became alert in the field of education. According to the jhumias, they are not atall ready to accept that their next generation will also have to survive working in field. The jhumias no doubt are more or less illiterate, but in the jhumia family with the decrease in age among the family members the literacy increases. That is we can find a decreasing rate of illiteracy among them. From the following table we can make out the change in the study area as:

Table 4: Education of the jhumias in the study areas

Education	Bagmara	Percentage	Salema	Percentage
Illiterate	19	27.14	24	22.86
Anganwari	4	5.71	5	4.76
Junior basic	20	28.57	54	51.43
Senier basic	21	30	16	15.24
Bording	6	8.57	6	5.72
Total	70	100	105	100

Source: Field survey

Thus we can make out that lies above 45 years of age are against in Jhum and are illiterate but those are at the age of less then 3 are in anganwari or not yet ready to study, and the middle age among this two are either completed their studies or are still in junior or senior basic school.

Change in barren lands: The empty lands in the area that is being mark out from the 2005 image has changed to forest or agricultural land in the 2013 image. There is a very small amount of area under degraded or barren land in 2013 where as the reverse is found in 2005. It can be make out that there must be decrease in jhum cultivation and thus less clearing of lands, and tribals over there is cultivating other crops and cutting less trees.

Jhum to rubber: The rate of jhum has decreased and the jhumias has changed their cropping to rubber. A numerous number of rubber cultivation in 2013 image is being newly introduced. Some of the rubber plantation is even done in place where jhum was done previously. It depicts that the jhumias is doing rubber in alternative to jhum.

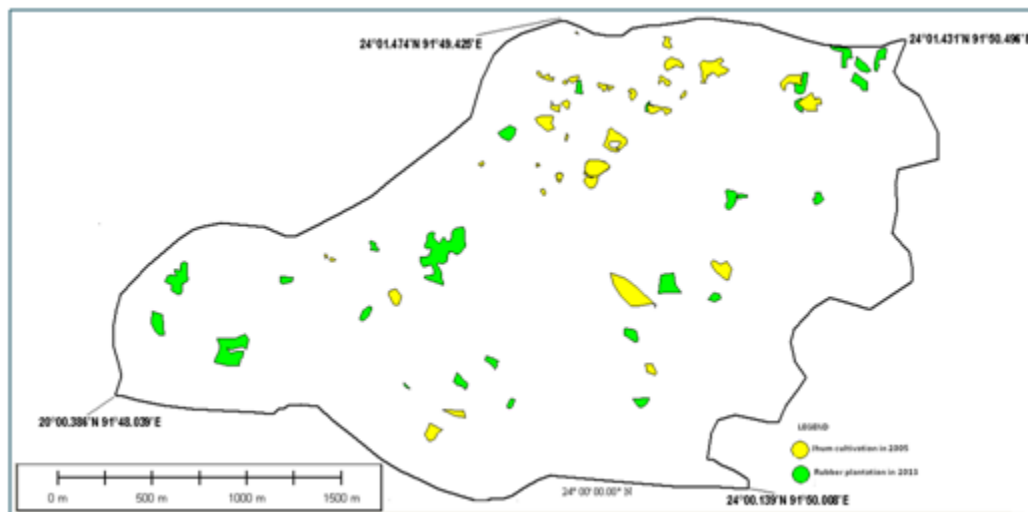


Fig 2: Rubber plantation of 2013 and jhum cultivation of 2005

From the house hold survey on the two villages of my study area it is being noticed that about 46.67% in Bagmara and 40% family members of the Jhumias commented that Jhum cultivation is on increasing rate. Whereas 53.33% on Bagmara and 60% persons on Salema commented that Jhum cultivation is decreasing. People want to shift from Jhum to rubber as it is more beneficiary then Jhum, and even less energy is needed for it.

Factors Responsible for the Failure of jhum Rehabilitation Scheme in Tripura

Jhumia rehabilitation scheme has achieved its goal in some extent and resettled Jhumias in alternative livelihoods but still in the Hilly parts of Tripura, the tribal people are doing jhum cultivation. The facts those are responsible for that are following-

1. Conceptualization and formulation of this scheme done unilaterally without involving the Jhumias as Govt. took this decision without knowing their interest.
2. Testing of scheme as pilot projects had not been done as it is necessary before implementing it.
3. Successful participation of the target population to generate a sagacity of belongingness has not done properly.
4. Poor research back-up.
5. Less integrated approach.
6. Lack of harmonization.
7. Sustained and intensive training to both scheme operators and Jhumias.
8. Lack of popularization of alternative livelihood approach for eradication of poverty

The Ideal Approach to Progress Shifting Cultivation

There can be two approaches to successfully manage the shifting cultivation in the states of north-east India. Tripura is a tiny state of north-east India and tribal people are practicing jhum cultivation in the hilly parts of Tripura. Considering the socio-cultural importance of jhum in the life of the people of Tripura, the most excellent strategy could be to modify and improved the jhum cultivation in a scientific way using modern agricultural tools and seeds to enhance the productivity and meet the necessities of the Jhumias. On the other hand, the existing forms of jhum cultivation may be replaced by new alternative schemes and programmes such as ideal landuse, horticulture landuse, livestock farming, fish farming, agro-industries, mushroom farming, sericulture, floriculture and piggery farming. While transforming and improving the existing jhum, the following aspects must be taken into consideration such as soil and water conservation, maintenance of soil fertility, crop diversity and high yielding seeds, food security, market linkages and deforestation as it is led to the climate change which nowadays amatter of global concern.

Aspects of Shifting Cultivation to be Managed for Effectiveness

In order to effectively manage the shifting cultivation, certain aspects pertaining to jhum cultivation need to be looked into for appropriate policy intervention and action. The issues to be considered for effective management of shifting cultivation in Tripura are follows-

1. Declining availability of forests and farmlands per households as population is increasing day by day and this for human intervention that people are clearing the forest areas and settled over there as space is constant in this world.
2. Emerging governmental policies and legal frameworks on land use and land rights that affect tribal population those who are practicing jhum cultivation in the hilly parts of Tripura.
3. Various Governmental policies are implementing to promote cash crop plantations in the hills.
4. Encourage market and export oriented production.
5. Development in education leads to migration of new generation in the urban areas for better opportunities lead to labour shortage for shifting cultivation as new generation don't like to practice jhum cultivation rather it is done by the aged persons whose age in between 40-60 years.
6. Recognize jhum cultivation as a form of agro-forestry having two distinct phases – cropping and fallow phases.

Bamboo Plantation in Tripura

Bamboo was raised in pure block plantations in the land of tribal beneficiaries and as one of the species mix in shelter belt of the new rubber plantations with financial assistance from Tripura Bamboo Mission since 2008-09. The Mission provided funds for 12 ha but the corporation as far created 33 ha of bamboo plantation

Improvement of Shifting Cultivation through Modern Technology in Tripura

Certain technological guidelines and principles those have been successfully applied in different parts of the world for the rehabilitation of shifting cultivation are listed below-

- (a) Maximize both cropping and fallow period and provide good varieties of seeds.
- (b) Identify innovative technologies, institutions and policies that can address two fundamental challenges – poverty eradication of tribal people (Jhumias) and protection of environment.
- (c) Adoption of wide spectrum of fallow management strategies.

- (d) Minimizing the slash and burning process of jhum cultivation and stop cutting the forest and start doing afforestation.
- (e) Accelerate fallows (fallow vegetation to be improved with nitrogen fixing trees to enrich the soil fertility).
- (f) Managed and enriched fodder fallows that it may use by tribal fallows to improve their socio-economic status.

CONCLUSIONS

Jhuming has a significant contribution to the total agricultural production of Tripura, no doubt, but its consequences are such that it causes certain economic problems which cannot be ignored. The most harmful consequence of jhuming follows from the fact that jhuming is not truly cultivation; it can be linked to mining. In cultivation conservation of soil to enable repeated rising of crops is an essential practice. But jhuming is a very exhaustive form of farming as the soil fertility stored for decades by the leaf fall on the forest are mined out of mixed-cropping in one operation only. Fertility is so exhausted by one use that nothing can be raised in the second year. Considering the lack of settled agricultural field, irrigation facilities, remoteness, high cost, labour and energy input involved in terrace cultivation, and in absence of other viable alternatives to shifting cultivation, the tribal population (aged people) of hilly Tripura are still continued to depend on shifting cultivation for their subsistence livelihood due to lack of floodplains for settled agriculture, increasing population growth, ecological fragile and hilly terrain of more than 30° slope. If the jhum cultivation is still continuing in its present form then land degradation, ecological balance, deforestation, soil loss and fertility, destabilization of slopes may happen and the impoverished living conditions of resource-poor upland farmers are bound to worsen with time as they don't have alternative sustainable livelihoods to feed their stomach. Furthermore, by destroying all vegetative cover over the soil jhuming exposes it to rain-water erosion. The topography of dhalai basin is such that jhuming does not only cause soil erosion but also leads to heavy silting of beds of hill-streams and chheras, etc. most of the heavy showers occur in the months of June, July, and August that is the month when jhum plots are under crops weeded clean. This is the most vulnerable moment for soil erosion as the rainfall is so high and soil condition is such that they are very loose and ready to erode. There is a very quick growth of crops and after that the land is left fallow. It must be mentioned that the jhumias are not quite blind to the need for adopting soil conservation measures. They adopt certain measures so that after one jhuming a patch does not lose all its fertility but can support the regeneration of forest species to enable jhuming again after the requisite period of fallowing. But then this is quite inadequate and insufficient to ensure successive farming of the clearing without causing any deterioration of soil and degradation of forest species. Because of such erosion of hill slopes the hill streams get silted up causing flood to the valley lands. Every year much damage is

caused to agricultural crops in the plains because of the rivers overflowing their banks. Most of these rivers are narrow and not navigable. Because of forest denudation water retaining capacity of the hill slopes falls and more water rolls down the slopes than the streams can carry and hence be in eroded. Repeated jhumming is held responsible for changing the ecological balance of the area even. The vegetation of the locality is the resultant effect of climatic, edaphic, physiographic and biotic factors. Land cleared of forest and persistently jhummed and abandoned is favourable for rubber cultivation in the area. Tropical evergreen forests which were jhummed several times and were then left to themselves have turned to mixed deciduous forests in the study area. The purpose of keeping jhum land fallow for a certain number of years is that the quickly growing forest and scrub, which draw fresh supplies of minerals up from the deep subsoil, restore the organic matter and nitrogen in the soil. Once the grasses take the place of trees such natural restoration of fertility is not possible.

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